REMARKS

This application has been carefully reviewed in light of the Office Action dated September 16, 2004. Claim 6 has been amended. Claims 27-44 have been added. Claims 6-10 and 27-44 are now pending. Applicants reserve the right to pursue the original claims and other claims in this and other applications. Applicants respectfully request reconsideration of the above-referenced application in light of the amendments and following remarks.

The Title of the Invention has been amended to correspond more closely with the pending claims. No new matter has been added. The Examiner's approval is respectfully solicited.

Claims 6 and 8-10 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Lee, et al. (U.S. Patent No.: 5,923,056) ("Lee"). The rejection is respectfully traversed.

Lee does not teach a method for forming a memory device comprising, "forming a gate dielectric . . . forming source and drain regions . . . forming a floating gate . . . forming a silicon-doped Al_2O_3 layer by chemical vapor deposition . . . subsequently implanting silicon into said CVD deposited Al_2O_3 layer by ion implantation to form a silicon-doped Al_2O_3 layer . . . and forming a control gate on said doped Al_2O_3 layer," as recited in claim 6 (emphasis added). In particular, Lee does not teach implanting silicon into a CVD deposited Al_2O_3 layer by ion implantation to form a silicon-doped Al_2O_3 layer.

For instance, Lee discloses in Example 1 that "doped and undoped aluminum oxide films were formed using reactive sputtering in an Argon/Oxygen atmosphere." (Col. 5, lines 59-60). As a result, "[a]n aluminum target with one percent by weight silicon distributed uniformly in the target was used to form the silicon-doped films."

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(Col. 5, lines 61-63) (emphasis added). Similarly, "[a]n aluminum target with 0.5 weight percent zirconium distributed uniformly in the target was used to form the zirconium-doped films." (Col. 5, lines 63-65) (emphasis added).

Lee does not teach implanting silicon into a CVD deposited Al_2O_3 layer by ion implantation to form a silicon-doped Al_2O_3 layer. Lee discloses that the IPD layer 124 (FIG. 2) is formed such that the aluminum oxide layer has a uniform dopant concentration. Lee teaches away from implanting silicon into a CVD deposited Al_2O_3 layer by ion implantation to form a silicon-doped Al_2O_3 layer. As indicated above, Lee discloses that "silicon is distributed uniformly in the target," and that a structure with a uniform deposition of dopant within the deposited Al_2O_3 layer results. (Col. 5, lines 61-63) (emphasis added).

In support of these arguments, Applicants respectfully direct the Examiner's attention to the Information Disclosure Statement filed on April 1, 2004, citing Section 9.2.2, "SUPREM III Models: Ion Implantation," *Silicon Processing for the VLSI Era*, Volume II, pages 658-661, and Chapter 9, "Ion Implantation for VLSI," *Silicon Processing for the VLSI Era*, Volume I, pages 280-327.

The disclosed references cited in the IDS indicate that ion implantation "is primarily used to add dopant atoms (most often selectively) into regions near the surfaces of silicon wafers." (Volume II, page 658) (emphasis added). Consequently, ion implantation does not result in a uniform doping profile. Accordingly, one skilled in the art would recognize that implanting silicon into a CVD deposited Al_2O_3 layer by ion implantation to form a silicon-doped Al_2O_3 layer is a completely different method than the method used to form Lee's uniformly-doped Al_2O_3 layer.

For example, implanting silicon into a CVD deposited Al_2O_3 layer by ion implantation to form a silicon-doped Al_2O_3 layer, allows one to selectively add dopant atoms to the surface and/or regions of the material yielding a uniquely formed structure, thereby eliminating the electrical defects associated with prior art structures. As a result, the resulting silicon-implanted Al_2O_3 layer, formed by ion implantation, would be structurally different from Lee's uniformly-doped Al_2O_3 layer. By virtue of the Al_2O_3 dopant ion implantation, Applicants' claimed Al_2O_3 layer is characterized by an absence of defects and traps "at the Al_2O_3/polysilicon interface." (Applicants' specification, page 10, lines 11-12).

For at least these reasons, claim 6 is not anticipated by Lee. Lee does not teach "implanting silicon into said CVD deposited Al_2O_3 layer by ion implantation to form a silicon-doped Al_2O_3 layer," as recited in claim 6 (emphasis added). Claims 8-10 depend from claim 6 and should be similarly allowable for at least the reasons provided above with regard to claim 6, and on their own merits. Accordingly, the § 102(e) rejection of claims 6 and 8-10 should be withdrawn.

Claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee in view of Ohzone, et al. (U.S. Patent No.: 5,250,455) ("Ohzone"). The rejection is respectfully traversed.

Claim 7 depends from claim 6 and should be allowable along with claim 6 for at least the reasons provided above. Specifically, Lee does not teach or suggest "implanting silicon into said CVD deposited Al_2O_3 layer by ion implantation to form a silicon-doped Al_2O_3 layer," as recited in claim 6 (emphasis added). Lee discloses that an aluminum target with one percent by weight silicon is distributed uniformly in the target to form a silicon-doped film (Col. 5, lines 61-63). As indicated previously, ion implantation allows one to selectively incorporate dopant ions into the aluminum oxide

layer and does <u>not</u> result in a uniformly-distributed doped layer. Accordingly, Lee does not teach or suggest implanting silicon into a CVD deposited Al_2O_3 layer by <u>ion implantation</u> to form a silicon-doped Al_2O_3 layer. Ohzone is relied upon for disclosing an energy of implantation and concentration, and adds nothing to rectify the deficiencies of Lee.

The Office Action asserts that Ohzone discloses that energy is varied according to the desired results such as the impurity density depth desired (pg. 4). Applicants respectfully submit, however, that the Office Action has failed to set forth a *prima facie* case of obviousness. <u>See</u> M.P.E.P. § 2142. In particular, Ohzone does not teach or suggest "forming said silicon-doped Al_2O_3 layer . . . [with] energy of approximately 10keV." The Office Action asserts that it would have been obvious to one having ordinary skill in the art at the time of the invention was made to have modified the energy of Ohzone to achieve the desired characteristics. However, neither Lee nor Ohzone teach or suggest forming a silicon-doped Al_2O_3 layer with energy of approximately 10keV. "To establish *prima facie* obviousness of a claimed invention, <u>all</u> the claim limitations must be taught or suggested by the prior art." M.P.E.P. § 2143.03 (emphasis added). Neither Lee nor Ohzone disclose or suggest <u>any</u> energies for forming a doped aluminum layer.

Moreover, it is not proper to combine references where doing so "would require a substantial reconstruction and redesign of the elements shown in the primary reference [i.e., Lee] as well as a change in the basic principle under which the primary reference [i.e., Lee] construction was designed to operate." <u>In re Ratti</u>, 270 F.2d 810, 813, 123 U.S.P.Q. 349, 352 (C.C.P.A. 1959). This is well-settled Office policy. <u>See</u> M.P.E.P. § 2143.01, page 2100-127 (Feb. 2003).

The 'modification' proposed by the Examiner, in the rejection of claim 7, requires a substantial reconstruction and redesign of Lee's elements, and changes the basic principle under which Lee was designed to operate. Lee discloses forming an aluminum target with silicon distributed uniformly in the target. Lee would not use 10keV for the energy of implanting dopants since it would achieve different impurity density depths. These are additional reasons for the allowance of claim 7. Withdrawal of the § 103(a) rejection for claim 7 is respectfully solicited.

In addition, Applicants respectfully submit that the prior art of record does not teach or suggest the subject matter of newly added claims 27-44. In particular, the prior art of record does not teach or suggest a method of forming a semiconductor device by "forming a first conductive layer over a semiconductor substrate; forming an Al_2O_3 layer over said first conductive layer; subsequently implanting dopants into said Al_2O_3 layer by ion implantation to form a dopant-implanted Al_2O_3 layer, wherein said dopant-implanted Al_2O_3 layer has a non-uniform doping profile; and forming a second conductive layer over said dopant-implanted Al_2O_3 layer," as recited in claim 27 (emphasis added), or a method of forming a memory device by "forming a gate dielectric on a semiconductor substrate between source and drain regions; forming a floating gate over said gate dielectric; forming a dopant-implanted insulating layer over said floating gate, said dopant-implanted insulating layer being formed by CVD deposition and ion implantation, wherein said dopant-implanted insulating layer has a dopant gradient; and forming a control gate over said dopant-implanted insulating layer," as recited in claim 44 (emphasis added).

As indicated previously, Lee does not teach or suggest forming a dopant-implanted Al_2O_3 layer by ion implantation which has a dopant gradient, or forming a dopant-implanted insulating layer by ion implantation which has a dopant gradient.

Lee merely discloses an aluminum target layer with silicon distributed uniformly in the target.

Applicants again turn the Examiner's attention to the Information Disclosure Statement filed on April 1, 2004, citing Section 9.2.2, "SUPREM III Models: Ion Implantation," *Silicon Processing for the VLSI Era*, Volume II, pages 658-661, and Chapter 9, "Ion Implantation for VLSI," *Silicon Processing for the VLSI Era*, Volume I, pages 280-327.

As the submitted IDS references indicate, with ion implantation, a non-uniform doping profile or dopant gradient is established within an Al_2O_3 implanted layer or dopant-implanted insulating layer when formed with ion implantation. That is, a higher dopant concentration is found at the surface, and is progressively lower as one proceeds from the surface into the bulk of the layer. One skilled in the art would know that Applicants' claimed method of ion implantation to form a dopant-implanted Al_2O_3 layer or dopant-implanted insulating layer, results in a higher concentration of dopants near a silicon/dielectric interface. This is a direct result of using ion implantation since ion implantation allows for dopants to be selectively implanted. This is not possible with Lee's methods. Claims 28-43 depend from claim 27 and should be similarly allowable along with claim 27 for at least the reasons provided above, and on their own merits.

In addition, the prior art of record does not teach or suggest, "wherein said step of ion implantation of dopants into the Al_2O_3 layer is conducted with energy of approximately 10keV," as recited in claim 33, or "wherein said first conductive layer is formed in a reaction chamber at a temperature from about 550 to about 650°C," as recited in claim 35, or "wherein said reaction chamber is held at a pressure of less than approximately 2 Torrs," as recited in claim 36, or "wherein said first conductive layer is

implanted with dopant ions to lower the resistivity of said first conductive layer," as recited in claim 37, or wherein said Al_2O_3 layer is CVD deposited with uniform coverage of approximately 0.2 to 1.0μ," as recited in claim 38, or ""wherein said dopant-implanted Al_2O_3 layer is annealed at a temperature from about 600 to about 950°C," as recited in claim 39, or "wherein said second conductive layer is formed in a reaction chamber at a temperature from about 550 to about 650°C," as recited in claim 40, or "wherein said second conductive layer is implanted with dopant ions to increase the conductivity of said second conductive layer," as recited in claim 42.

The prior art of record does not teach or suggest annealing, much less the annealing temperatures of a first or second conductive layer. Further, the prior art of record does not teach or suggest that implanting, much less implanting the first and second conductive layers with dopant ions to decrease the resistivity or increase the conductivity. Further still, the prior art of record does not teach or suggest annealing the dopant-implanted Al_2O_3 layer, much less depositing a dopant-implanted Al_2O_3 layer with uniform coverage of approximately 0.2 to 1.0μ over the first conductive layer. These are additional reasons for the allowance of claims 28-43.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

By____________________

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